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H. C. Lint.

SEED AND SOIL TREATMENT FOR THE CONTROL OF POTATO SCAB[1]

Scabby Potatoes Grown on Limed Plot.

Clean Potatoes Grown on Adjoining Unlimed Plot.

For the past three years the department of plant pathology of the New Jersey Agricultural Experiment Station has conducted a large number of experiments dealing with the control of potato scab. This is one of the most common diseases encountered by growers and sometimes results in quite serious loss.

This loss may take place in two ways: (1) The actual yield may be diminished because of the disease; and (2) the selling price may be cut below the ordinary market price in cases where the disease is severe. In any event, the presence of scab means a loss to the ultimate consumer because of the deep paring necessary to remove the deep, unsightly scab lesions.

[1]Prepared by Henry Clay Lint, Ph. D., formerly of the Department of Plant Pathology, April 1, 1918.

Nature of the Disease

Scab, as most growers are aware, is produced by a definite organism, one of the higher bacteria *(Actinomyces chromogenus)* which lives in the soil from year to year. On a soil generously supplied with organic matter the organisms will live almost indefinitely. Liming the soil is known to favor the development of scab; likewise wood ashes and nitrate of soda, in fact all kinds of fertilizing materials which tend to make the soil sweet or alkaline, are favorable to scab.

On the other hand, materials like acid phosphate, kainit, sulfate of ammonia and other substances which make the soil acid, or sour, tend to inhibit scab.

In addition to the scab organism in the soil, the disease can be distributed through the use of scabby potatoes. In fact, it is quite probable that most potato fields were originally infected through the use of scabby seed.

This means that the problem of eliminating the scab must be approached from two angles: (1) seed treatment and (2) soil treatment.

There are two solutions now used quite extensively to destroy the scab organism on the seed tuber. They are: (1) corrosive sublimate, and (2) formalin. The use of these solutions is fully described in Circular 53 of this Station.

As stated previously, any material that tends to render the soil acid makes conditions unfavorable for the development of scab. In our experimental work we have used sulfur in various ways and amounts. When applied to the soil it is transformed to sulfuric acid, thus making the soil unfavorable to the scab organism. It is probable that other products besides sulfuric acid are instrumental also, but the reason why sulfur should be effective is readily apparent.

Sulfur has been used in a variety of ways under a number of different conditions to destroy potato scab. The results have not always been satisfactory, so the studies at the Experiment Station were designed to throw light on the various factors which tend to make the sulfur more or less effective.

The experiments have all been of the field type, conducted in cooperation with practical growers, and all of the points tested have a practical bearing upon the ordinary methods used in growing potatoes. The influence of these various factors will be taken up separately.

Presence of a Cover Crop

Practically all progressive growers in New Jersey now sow a cover crop on the soil which is to be in potatoes the following year. It was therefore considered of importance to learn to what extent the presence of a cover crop aids or interferes with sulfur in combating the scab.

The results of experiments illustrate the influence of a cover crop on the yield itself and on the efficiency of sulfur as well.

Untreated soil showed an average yield of 192 bushels per acre without a cover crop, as compared with 213 bushels per acre where a cover crop had been grown. Less scab was on the crop from the plots with a cover crop than on the plots without.

The sulfur was from two to five times more effective on soil with a cover crop than on soil without a cover crop.

Time of Application

In a test of the fall application of sulfur as compared with a similar one made the following spring, it was found that the number of clear tubers was increased but 4.61 per cent from the fall application as compared with an increase of 26.91 per cent for the spring. Apparently the fall application is not to be recommended.

Rate of Application

Sulfur has been used at the rates of 300, 600 and 900 pounds per acre. The use of any quantity over 600 pounds per acre is not to be advised except under especially alkaline conditions. With most potato soils which are ordinarily acid, it will be found best to use about 300 pounds per acre. The control of scab is not so good with this quantity as with the larger amounts, but there is little if any danger attached to its use. The most rational recommendation offered as a result of this work is the annual application of sulfur at the rate of about 400 pounds per acre. When combined with seed treatment it should be possible practically to eliminate scab and at the same time do no injury to the soil, through the annual usage of 300 pounds of sulfur per acre.

Seed Treatment

From the results on this phase of the problem it appears that either the formalin or corrosive sublimate treatments result in both an increase in yield and a decrease in the amount of scab. In the experiment with sulfur this material was found more effective on the treated seed since it has only the organism in the soil to combat.

Method of Application

Four different methods of application have been tried:

(1) Broadcasting before planting, (2) broadcasting after planting, (3) applying in mixture with the fertilizer, and (4) applying on top of the potato ridge.

Of these four methods the broadcasting either before or after planting is advisable. In the experimental work broadcasting after plowing and harrowing but before planting gave the best results.

Applying sulfur in a mixture with the fertilizer is the most convenient method, but the sulfur is not so effective and a decrease in the yield quite generally results where this plan is followed.

When sulfur is applied on top of the ridge after planting the scab is controlled satisfactorly, but the yield is so decreased that this method is not recommended.

Influence of Variety

Of the varieties grown commercially in New Jersey, only the Irish Cobbler and Green Mountain scab to such an extent that soil treatment need be adopted. With the Giants and other "long stock", the sulfur appeared to give a whiter skin and finer texture, but the benefits will seldom be found commercially profitable.

With the Irish Cobbler, particularly where grown on the same soil for a number of years, it will sometimes be commercially profitable to adopt the sulfur method for the eradication of scab.

Influence of the Fertilizing Constituents

For the guidance of growers who prepare their own mixed fertilizers, the following points brought out in the experimental work are of interest.

1. Nitrate of soda tends to increase scab, whereas sulfate of ammonia tends to inhibit it.
2. Acid phosphate tends to eradicate scab in the soil, whereas bone phosphate tends to increase it.
3. Wood ashes and lime leave the soil alkaline and hence favor the development of scab.
4. When sulfur is used to combat scab it will be found advisable to use sulfate of ammonia rather than nitrate of soda and acid phosphate rather than steamed bone.

The most logical method of eradicating scab as indicated by the results of the last three years' experimental work lies in the combined use of all the seed, soil, fertilizer and cultural treatments known to inhibit its development.

Summary

1. The growing of a cover crop ordinarily tends to decrease the intensity of the scab attacks.
2. Sulfur is more effective on soil with a cover crop than on soil without a cover crop.
3. Do not apply alkaline materials such as lime, wood ashes, or steamed bone.
4. Treat the seed potatoes. Either formalin or corrosive sublimate will kill scab, but since corrosive sublimate is more effective against *Black Scurf* or *Rhizoctonia* it is preferable.
5. Sulfur quite generally cuts down on the amount of scab. Annual applications of about 300 pounds per acre would not decrease the yield or injure the crop-producing power of the soil. The use of larger amounts sometimes decreases the yield the following year, but in no case has any permanent injury been done to the soil.
6. The most effective way to apply sulfur is to broadcast with a lime distributor after the soil is plowed and harrowed but before planting.